What is claimed is:

Claims:

1. A method for producing semiconducting carbon nanotubes, comprising:

synthesizing conducting carbon nanotubes to a first length on a first plurality of synthesis sites carried by a substrate; and

synthesizing semiconducting carbon nanotubes to a second length on a second plurality of synthesis sites carried by the substrate, the second length of the semiconducting carbon nanotubes being greater than the first length of the conducting carbon nanotubes.

2. The method of claim 1 wherein synthesizing the conducting carbon nanotubes occurs concurrently with synthesizing the semiconducting carbon nanotubes.

3. The method of claim 1 wherein synthesizing the conducting carbon nanotubes further comprises:

orienting each of the conducting carbon nanotubes substantially vertically to a corresponding one of the first plurality of synthesis sites during synthesis.

4. The method of claim 1 wherein synthesizing the semiconducting carbon nanotubes further comprises:

orienting each of the semiconducting carbon nanotubes substantially vertically to a corresponding one of the second plurality of synthesis sites during synthesis.

5. The method of claim 1 wherein synthesizing conducting carbon nanotubes further comprises:

altering the first plurality of synthesis sites, after the first length is attained, to prevent synthesis of the conducting carbon nanotubes.

6. The method of claim 5 wherein altering the first plurality of synthesis sites comprises:

electrolytically etching the first plurality of synthesis sites, after the first length is attained, to an extent sufficient to prevent synthesis of the conducting carbon nanotubes.

7. The method of claim 1 wherein the second length is at least twice as long as the first length.

8. The method of claim 1 wherein a single semiconducting carbon nanotube is carried by each of the second plurality of synthesis sites.

9. The method of claim 1 wherein synthesizing conducting carbon nanotubes comprises:

performing a chemical vapor deposition process on a catalyst material carried by each of the first plurality of synthesis sites.

10. The method of claim 1 wherein synthesizing semiconducting carbon nanotubes comprises:

performing a chemical vapor deposition process on a catalyst material carried by each of the second plurality of synthesis sites.

11. The method of claim 1 further comprising:

harvesting the semiconducting carbon nanotubes.

12. The method of claim 1 further comprising:

fabricating a device structure on the substrate that incorporates the semiconducting carbon nanotubes.

13. The method of claim 1 wherein each of the semiconducting carbon nanotubes includes a free end and one of a plurality of third synthesis sites at the free end.

14. The method of claim 13 wherein each of the plurality of third synthesis sites originates from a corresponding one of the second plurality of synthesis sites at the time of nanotube nucleation.

15. The method of claim 13 further comprising:

forming a prophylactic barrier on the substrate to prevent synthesis of the conducting carbon nanotubes at the first plurality of synthesis sites after the first length is attained.

16. The method of claim 1 wherein said semiconducting carbon nanotubes are multi-wall semiconducting carbon nanotubes.

17. A method for producing semiconducting carbon nanotubes, comprising:

synthesizing conducting carbon nanotubes on a first plurality of synthesis sites carried by a substrate;

synthesizing semiconducting carbon nanotubes on a second plurality of synthesis sites carried by the substrate;

interrupting the synthesis of the conducting and the semiconducting carbon nanotubes;

altering the first plurality of synthesis sites to prevent resumed synthesis of the conducting carbon nanotubes; and

resuming the synthesis of semiconducting carbon nanotubes at the second plurality of synthesis sites to lengthen the semiconducting carbon nanotubes relative to the conducting carbon nanotubes.

18. The method of claim 17 wherein each of the first and second pluralities of synthesis sites includes a seed pad of a catalyst material capable of supporting carbon nanotube synthesis.

19. The method of claim 18 wherein altering the first plurality of synthesis sites comprises:

separating each of the conducting carbon nanotubes and the seed pad of the corresponding one of the first plurality of synthesis sites.

20. The method of claim 19 wherein separating each of the conducting carbon nanotubes comprises:

electrolytically etching the catalyst material forming the seed pad to an extent sufficient to separate each of the conducting carbon nanotubes and the seed pad of the corresponding one of the first plurality of synthesis sites.

21. The method of claim 18 wherein altering the first plurality of synthesis sites comprises:

covering the seed pad of each of the first plurality of synthesis sites with a plating barrier effective to prevent continued synthesis of the conducting carbon nanotubes.

22. The method of claim 17 wherein altering the first plurality of synthesis sites comprises:

performing an electrolytic etching process effective to separate each of the conducting carbon nanotubes and the corresponding one of the first plurality of synthesis sites.

23. The method of claim 17 wherein a single semiconducting carbon nanotube is carried by each of the second plurality of synthesis sites.

24. The method of claim 17 wherein synthesizing conducting carbon nanotubes comprises:

performing a chemical vapor deposition process on a catalyst material carried by each of the first plurality of synthesis sites.

25. The method of claim 17 wherein synthesizing semiconducting carbon nanotubes comprises:

performing a chemical vapor deposition process on a catalyst material carried by each of the second plurality of synthesis sites.

26. The method of claim 17 wherein resuming the synthesis of semiconducting carbon nanotubes comprises:

performing a chemical vapor deposition process on a catalyst material carried by each of the second plurality of synthesis sites.

27. The method of claim 17 further comprising:

harvesting the semiconducting carbon nanotubes lengthened by the resumed synthesis.

28. The method of claim 17 further comprising:

fabricating a device structure on the substrate that incorporates the semiconducting carbon nanotubes lengthened by the resumed synthesis.

29. The method of claim 17 further comprising after interrupting the synthesis and before altering the first plurality of synthesis sites:

coupling a conductive layer with corresponding free ends of the conducting carbon nanotubes and the semiconducting carbon nanotubes that is electrically isolated by a dielectric layer from the first and second pluralities of synthesis pads;

attaching the conductive layer to a handle wafer; and

separating the first and second pluralities of synthesis sites from the substrate.

30. The method of claim 29 further comprising:

recessing the dielectric layer by etching to expose the first and the second pluralities of synthesis sites.

31. The method of claim 17 wherein altering the first plurality of synthesis sites further comprises:

electrolytically etching the first plurality of synthesis sites to an extent sufficient to separate each of the conducting carbon nanotubes and the corresponding one of the first plurality of synthesis sites.

32. The method of claim 31 wherein electrolytically etching the first plurality of synthesis sites further comprises:

immersing the substrate in an electrolytic solution; and

applying an electrical current through the conducting carbon nanotubes effective to cause the electrolytic solution to etch each of the first plurality of synthesis sites at an interface with the corresponding one of the conducting carbon nanotubes.

33. The method of claim 32 wherein resuming synthesis further comprises:

performing a chemical vapor deposition process at the second plurality of synthesis sites effective to lengthen each corresponding semiconducting carbon nanotube.

34. The method of claim 17 wherein altering the first plurality of synthesis sites comprises:

covering each of the first plurality of synthesis sites with a plating barrier effective to prevent continued synthesis of the conducting carbon nanotubes.

35. The method of claim 34 wherein altering the first plurality of synthesis sites further comprises:

immersing the substrate in an electrolytic solution; and

applying an electrical current through the conducting carbon nanotubes effective to cause the plating barrier to cover each of the second plurality of synthesis sites.

36. The method of claim 35 wherein resuming synthesis further comprises:

performing a chemical vapor deposition process at the second plurality of synthesis sites effective to lengthen each corresponding semiconducting carbon nanotube.

37. The method of claim 17 wherein said semiconducting carbon nanotubes are multi-wall semiconducting carbon nanotubes.

38. A method for producing semiconducting carbon nanotubes, comprising:

synthesizing conducting carbon nanotubes on a first plurality of synthesis sites carried by a substrate, each of the conducting carbon nanotubes including a free end and one of a second plurality of synthesis sites at the free end;

synthesizing semiconducting carbon nanotubes on a second plurality of synthesis sites carried by the substrate, each of the semiconducting carbon nanotubes including a free end and one of a fourth plurality of synthesis sites at the free end;

interrupting the synthesis of the conducting and the semiconducting carbon nanotubes;

forming a prophylactic barrier on the substrate to prevent synthesis of the conducting carbon nanotubes at the first plurality of synthesis sites and the synthesis of semiconducting carbon nanotubes at the third plurality of synthesis sites;

altering the second plurality of synthesis sites to prevent resumed synthesis of the conducting carbon nanotubes; and

resuming the synthesis of the semiconducting carbon nanotubes at the fourth plurality of synthesis sites to lengthen the semiconducting carbon nanotubes relative to the conducting carbon nanotubes.

39. The method of claim 38 wherein forming the prophylactic barrier further comprises:

burying the first, second, third and fourth pluralities of synthesis sites in a dielectric layer so that a synthesis-promoting reactant cannot reach said first and third pluralities of synthesis sites.

40. The method of claim 39 further comprising:

recessing the dielectric layer by etching to expose the second and fourth pluralities of synthesis sites.

41. The method of claim 40 wherein altering each of the second plurality of synthesis sites further comprises:

electrolytically etching each of the second plurality of synthesis sites to an extent sufficient to separate each of the conducting carbon nanotubes and the corresponding one of the second plurality of synthesis sites.

42. The method of claim 41 wherein electrolytically etching further comprises:

immersing the substrate in an electrolytic solution; and

applying an electrical current through the conducting carbon nanotubes effective to cause the electrolytic solution to etch each of the second plurality of synthesis sites.

43. The method of claim 42 wherein resuming synthesis further comprises:

performing a chemical vapor deposition process at each of the fourth plurality of synthesis sites effective to lengthen the semiconducting carbon nanotubes.

44. The method of claim 40 wherein altering the second plurality of synthesis sites further comprises:

immersing the substrate in an electrolytic solution; and

applying an electrical current through the conducting carbon nanotubes effective to form a plating barrier covering the second plurality of synthesis sites.

45. The method of claim 44 wherein resuming synthesis further comprises:

performing a chemical vapor deposition process at the fourth plurality of synthesis sites effective to lengthen the semiconducting carbon nanotubes.

46. The method of claim 38 wherein the second plurality of synthesis sites and the fourth plurality of synthesis sites originate from the corresponding one of the first plurality and the third plurality of synthesis sites, respectively, at the time of nanotube nucleation.

47. The method of claim 38 wherein altering the second plurality of synthesis sites comprises:

separating each of the conducting carbon nanotubes and the corresponding one of the second plurality of synthesis sites.

48. The method of claim 47 wherein separating each of the conducting carbon nanotubes comprises:

electrolytically etching the catalyst material forming the second plurality of synthesis sites to an extent sufficient to separate each of the conducting carbon nanotubes from the corresponding one of the second plurality of synthesis sites.

49. The method of claim 38 wherein altering the second plurality of synthesis sites comprises:

form a plating barrier covering the second plurality of synthesis sites effective to prevent continued synthesis of the conducting carbon nanotubes.

50. The method of claim 38 wherein a single semiconducting carbon nanotube is carried by each of the third plurality of synthesis sites.

51. The method of claim 38 wherein synthesizing conducting carbon nanotubes comprises:

performing a chemical vapor deposition process at the first plurality of synthesis sites.

52. The method of claim 38 wherein synthesizing semiconducting carbon nanotubes comprises:

performing a chemical vapor deposition process at the third plurality of synthesis sites.

53. The method of claim 38 wherein resuming the synthesis of semiconducting carbon nanotubes comprises:

performing a chemical vapor deposition process at the fourth plurality of synthesis sites.

54. The method of claim 38 further comprising:

harvesting the semiconducting carbon nanotubes lengthened by the resumed synthesis.

55. The method of claim 38 further comprising:

fabricating a device structure on the substrate that incorporates the semiconducting carbon nanotubes lengthened by the resumed synthesis.

56. The method of claim 38 wherein said semiconducting carbon nanotubes are multi-wall semiconducting carbon nanotubes.

57. A structure comprising:

a substrate carrying a plurality of first and a plurality of second synthesis sites each configured for synthesizing carbon nanotubes;

a plurality of semiconducting carbon nanotubes each carried by one of the first plurality of synthesis sites; and

a plurality of conducting carbon nanotubes each carried by one of the second plurality of synthesis sites, each of said plurality of conducting carbon nanotubes characterized by a first length less than a second length characterizing each of said plurality of semiconducting carbon nanotubes.

58. The structure of claim 57 wherein each of said second plurality of synthesis sites carries one of said plurality of semiconducting carbon nanotubes.

59. The structure of claim 57 wherein each of said plurality of semiconducting carbon nanotubes includes a free end and one of a third plurality of synthesis sites at the free end capable of supporting semiconducting carbon nanotube synthesis.

60. The structure of claim 59 wherein a free end of each of said plurality of conducting carbon nanotube lacks a synthesis site.

61. The structure of claim 59 further comprising:

a dielectric layer burying said first and second pluralities of synthesis sites so that a synthesis-promoting reactant cannot reach said first and second pluralities of synthesis sites.

62. The structure of claim 57 wherein a single semiconducting carbon nanotube is carried by each of said second plurality of synthesis sites.

63. The structure of claim 57 wherein said second length is at least twice as long as said first length.

64. The structure of claim 63 wherein said first length is in the range of about 100 nm to about 200 nm.

65. The structure of claim 57 wherein said semiconducting carbon nanotubes are multi-wall semiconducting carbon nanotubes.